

Ovis Cowani, sp. n.

This Sheep is nearest to *O. stonei*, but differs in being entirely deep black, with the exception of a white rump-patch and a grey face. The rump-patch is considerably smaller than in *O. stonei*. The three-year old ram of *O. stonei* is occasionally much darker than a specimen of that species in my possession, but is always of a rusty or brownish black, and has the very large white rump-patch.

The type specimen of *O. cowani* was entire, but the skin had only been dried and not dressed, and when relaxed the whole of the hair came off, and only the head and neck could be saved.

The type, shot by an Indian out of a large flock, was sent me by Mr. C. G. Cowan, of Kamloops, and was obtained in the mountain-chain near Mount Logan in British Columbia.

Types of all these four species and subspecies are in the Tring Museum.

2. On Elephant Remains from Crete, with Description of
Elephas creticus, sp. n. By DOROTHEA M. A. BATE.*

[Received February 1, 1907.]

(Plates XII. & XIII.†, and Text-figure 83.)

Introduction.

Perhaps the most important and interesting of the results of the author's visit to Crete in 1904 was the discovery, in two hitherto unexplored cave-deposits, of the remains of Elephants of different sizes, more particularly as the occurrence of one of these, of pigmy proportions, appears not to have been previously known.

Although prior to 1904 no large quantity of specimens seems to have been obtained, yet the existence of ossiferous deposits in this island has been known for a considerable time, as the following records testify. The earliest would seem to be that of Pococke, who described a bone-cave in the Khania Akrotiri in a volume published in the middle of the eighteenth century‡. Nearly a hundred years after this, a reference occurs relating to fossilised human remains found, together with marine forms, near Khania by Fabrequette§, who was at one time Consul at Malta. Later, remains of a Hippopotamus, which probably came from the upland basin of Lassethy, were obtained by more than one traveller||, and have since been referred to by a number of writers. Two ossiferous caves were discovered in the west of the island by

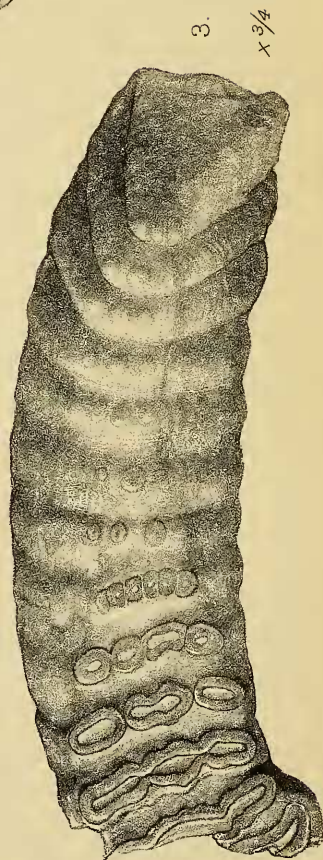
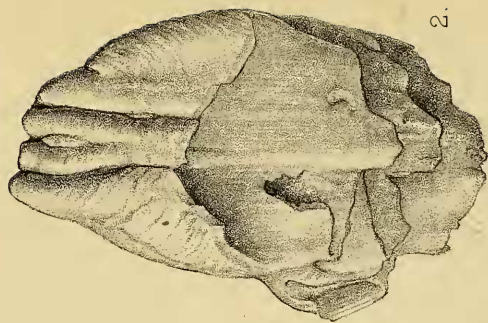
* Communicated by HENRY WOODWARD, LL.D., F.R.S., V.P.Z.S., F.G.S.

† For explanation of the Plates, see p. 250.

‡ Richard Pococke, 'A Description of the East' (London, 1745), vol. ii. p. 264.

§ C. R. Acad. Sci. (Paris), iv. 1837, p. 182; also *ibid.* viii. 1839, p. 178.

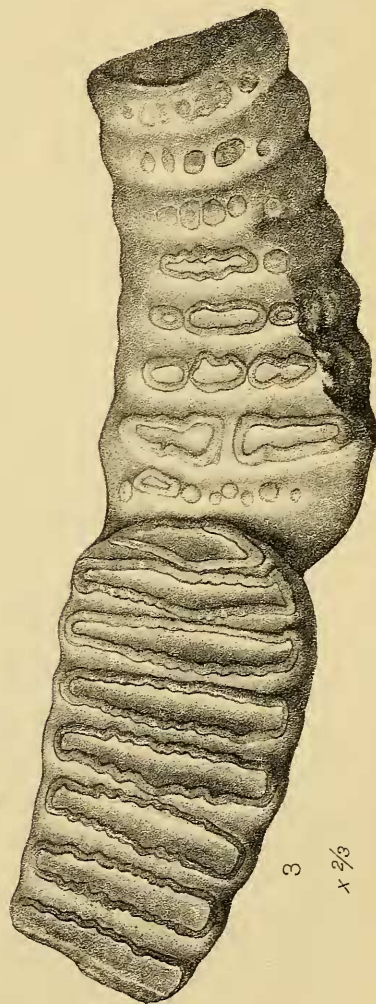
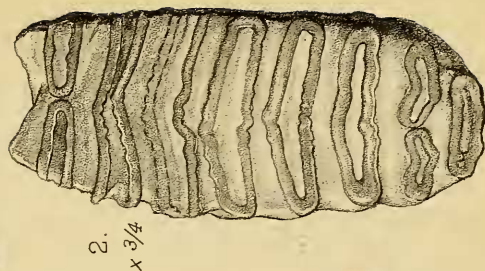
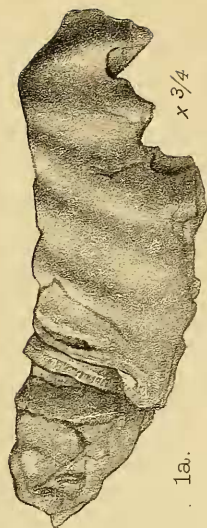
|| See Admiral Spratt, 'Travels and Researches in Crete' (London, 1865), vol. ii. pp. 386-7; also Raulin, 'Description Physique de l'Île de Crète' (Paris, 1869), vol. i. p. 156, and vol. ii. p. 615.



G.M. Woodward del. et lith.

ELEPHANT REMAINS FROM CRETE.

West, Newman imp.



Admiral Spratt*, both of which have since been visited by the present writer†.

Signor Simonelli, whose geological researches in Crete were carried on in 1893, was seemingly the first to obtain Elephant remains, which he procured from caves near Retymno, which is situated on the north coast and lies between Khania and Candia. In a paper published in 1894‡ he identifies the specimens, which included a perfect mandibular ramus, as those of *Elephas prisceus* (= *E. antiquus* §), though no detailed descriptions or figures are given, and I have been able to find no other published reference to them.

Unfortunately the collection of teeth and limb-bones which forms the subject of the present paper consists of a small amount of material only, many of the specimens being but imperfectly preserved. Notwithstanding this they fall naturally into two groups representing animals of different sizes, the smaller of which agrees in this respect with *E. melitensis*, whilst a number of limb-bones indicate an Elephant superior in dimensions to the average Indian species (*E. maximus*) of the present day, but not equalling the gigantic proportions at times attained by *E. meridionalis* and *E. antiquus*, though, as will be shown later, it is to this last that they must evidently be referred. Thus at first sight it seemed probable that the collection included remains of both a dwarfed race and the parent form from which it had sprung. However, before remarking on the relationships suggested by a study of the specimens obtained, it will perhaps be more convenient first to briefly describe them, commencing with those by which the pigmy form is represented.

I. *Elephas creticus*, sp. n.

The remains of the smallest of the Cretan Elephants were all obtained from a much damaged and weathered cave-deposit in the limestone cliffs near Cape Maleka in the west of the island, which has already been described||, and where only some teeth and limb-bones of small rodents were found besides those under discussion. These latter include nine imperfect molars and a few fragments, among which are a portion of an incisor and the dorsal half of a vertebra. As this small race differs from those of other Mediterranean islands, and its minute proportions being seemingly the result of specialisation due to isolation in Crete, it is suggested that it may be known by the above specific name denoting its island habitat.

Incisors.—Of the milk-incisors no specimen was procured, while, as already remarked, only a fragment of the proximal end of a permanent tusk (M. 9375) was obtained. From the limited

* *Op. cit.* vol. ii. pp. 194-5.

† *Geol. Mag.* n. s. dec. v. vol. ii. (1905) pp. 194-6.

‡ *Atti R. Accad. Lincei*, 5^a ser. Rendiconti, vol. iii. 1894, Sem. 2, pp. 265, 268 ; also 'Candia' (Parma, 1897), pp. 171-2.

§ *Cat. Foss. Mamm. Brit. Mus.* part iv. (London, 1886) p. 122.

|| *Geol. Mag.* n. s. dec. v. vol. ii. (1905) p. 195.

extent of the pulp-cavity, it is believed to have belonged to a nearly adult individual and indicates a tooth of small size, though its condition is too imperfect to admit of any measurements being given other than its approximate diameter, which is 46 mm.

Upper Molars.—Only two of the nine molars are considered to belong to the upper series; the smaller of these (M. 9376), a *first true molar*, is split longitudinally almost in half, but sufficient remains to show the general character of the tooth. It consists of seven plates, though it is possible that an additional small anterior ridge was originally present. Its antero-posterior length is 54 mm. and height about 32 mm., although the fangs extended for a short distance further, bringing the total measurement up to 41 mm. Comparatively speaking, the height of this tooth is slightly greater than in most of the other specimens referred to *E. creticus*; this is an argument in favour of its being a first true molar rather than the last of the milk-series, which, from its size alone, it might perhaps have been thought to represent. The enamel bands are not very thick and in several of the ridges are somewhat broken up into "rings"; at the same time, the cement-areas are broad, a character generally found in conjunction with more massive enamel. In section this tooth shows that the cement-areas maintain an almost uniform width for nearly the whole of their extent. This feature is probably not infrequent in the molars of this species, as suggestively exemplified by some of the extensively worn specimens described below.

The Cretan specimen is superior in antero-posterior length to an example of the corresponding tooth of *E. cypriotes* (M. 8602)*, though this latter exceeds it in the height of its crown, which is 53.5 mm.; this difference in the proportions is even more marked in a molar of *E. melitensis* (44252)†.

The second specimen (M. 9377, Pl. XIII. fig. 2), believed to belong to the upper series, is of larger proportions than the last, and is much worn and somewhat damaged; it probably represents the *penultimate true molar*. It is difficult to say of how many plates it originally consisted, but it can be seen that there were at least eight, all of which were in use, the front ones being worn down almost to their common base, while a portion of the anterior ridge is broken off. Partly owing to its advanced state of wear, the crown is very wide, being 37 mm. across, while its antero-posterior length is 77 mm. and its height 37 mm., though this would of course have been greater when the tooth was still but slightly abraded. In spite of the condition of this molar the cement-areas are still broad, equalling or even exceeding in size the plates of dentine; the enamel bands are thick and in a few instances somewhat wavy in outline.

Although apparently considerably superior in height of crown, this tooth in *E. cypriotes* is otherwise decidedly smaller than the above, the dimensions of a much less worn example (M. 8601)

* Figured, Phil. Trans. vol. 197 B (1904), p. 351, pl. 21. figs. 4, 4a.

† Trans. Zool. Soc. vol. ix. p. 20, pl. 2. figs. 9, 9a.

being:—approximate antero-posterior length 72 mm., greatest width of crown 28 mm., and total height 65 mm. Compared with the specimen (49267)* identified by Falconer as *M. 1* of *E. melitensis*, this last is somewhat narrower in the crown, which is 33 mm. across, though this may be partly accounted for by the difference in age, and it is likely that the two would originally have closely agreed in this respect. On the other hand, in height the molar from Malta greatly exceeds the one from Crete, being very high in relation to its width, as already noted by Falconer; further, the cement-areas in the Cretan fossil are distinctly broader.

Lower Molars.—Of the seven molars obtained not one can be referred to a position among the milk-teeth, while, owing to imperfect preservation, it is impossible in one or two cases to make certain of the place originally occupied in the permanent series. The first true molar appears not to be represented. Two specimens, both belonging to the right side of the mandible, are believed to be *second true molars*. One (*M. 9378 a*) has been considerably weathered and is much worn, all except the last of the plates having been in use; the number of these was at least nine. The cement-areas are broad and the enamel bands thick and smooth, while in two, if not three, of them there is a median loop, though this is unaccompanied by a mesial expansion of the plates of dentine.

The other tooth (*M. 9378*, Pl. XIII. figs. 1, 1 *a*), regarded as a second true molar, is also extensively worn, the penultimate ridge being already slightly abraded; although it is broken off anteriorly seven plates remain as well as a portion of an eighth. The width of the seventh plate (counting from the rear) is 37 mm., while the height of the preantepenultimate one is only 33 mm.; the enamel is massive and in the four posterior used plates is somewhat irregular, while the cement separating the anterior ridges is considerably excavated. A comparison shows this Cretan specimen to be broader and much lower in the crown than a corresponding, though less worn, tooth of *E. cypriotes* (*M. 8588*)†.

Judging from their size it is probable that two other lower true molars, very imperfectly preserved, also represent the second of the permanent series. One of these (*M. 9382*) is situated in the posterior half of a left mandibular ramus; it probably consisted of eight or nine plates and, like most of the teeth obtained of *E. creticus*, is low-crowned and has thick enamel bands and wide cement-areas. The other example (*M. 9380*) is a portion of a much damaged right molar; the worn surfaces of two ridges remain and seem in no way to differ from those of the specimens already described.

The last lower molar (*M. 3*) is represented by three specimens, none of which is in an advanced stage of wear. Two of these,

* Falconer, Pal. Mem. vol. ii. pl. 11. figs. 2, 2 *a*, p. 294; also identified by Busk as *M. 1* of *E. falconeri*, Trans. Zool. Soc. vol. vi. part v. pl. 53. figs. 9, 9 *a*.

† Phil. Trans. vol. 197 B (1904), p. 355, pl. 21. figs. 3, 3 *a*.

damaged anteriorly, are each situated in a portion of a ramus; and belonging, as they do, to opposite sides of the mandible as well as being in a similar stage of wear, it is thought that they may have been owned by a single individual. On the left side (M. 9383 *a*, Pl. XII. fig. 1), in addition to the last molar, the three posterior plates of M. 2 are also present. In M. 3 eleven plates can be counted, but a considerable part of the posterior portion of the tooth is wanting. The fifth plate is slightly abraded, and it is noticeable in both this and the companion specimen that the enveloping cement on the grinding-surface of the crown is somewhat scanty, with the result that all the enamel soon becomes exposed, even while the anterior portion of the tooth may still be but little worn. The second example (M. 9383 *b*) presents very similar characteristics; the presence of eleven plates can be determined, but damage anteriorly and concealment of the tooth behind by the bone and matrix make it impossible to ascertain the original total.

The one other last true molar (M. 9381, Pl. XII. fig. 3), an isolated tooth of the left side, is almost perfectly preserved except for the loss of the greater part of the first and a portion of the second plate. It is considerably curved, this being accentuated by the angle at which the hinder plates lie. The number of ridges is thirteen, six of which show signs of more or less wear, and there appears to be no evidence of the former presence of any additional ones. The sloping, instead of upright, position of the last plate is a further indication that this molar must be considered an example of the last of the permanent series. The antero-posterior length of the tooth (not along the curve) is about 122 mm., or 139 mm. if continued to the heel of its base; the greatest height, which occurs at the sixth plate, is 53 mm., while the width of the abraded surface of the third ridge is 35 mm. The cement-areas are of medium width and the enamel bands thick and uncrimped, though somewhat irregular and disconnected in the less-worn plates.

It is interesting to contrast this with two corresponding teeth of *E. cypriotes* in the British Museum Collection*, all three being of the left side and in practically a similar stage of use. The Cretan fossil is the more massive and superior in width and antero-posterior length, the persistence of the annulation of the enamel bands is also more strongly marked. On the other hand, it has a lower crown (53 mm.), both actually and as compared with its bulk, than the Cypriote specimens, this being 59 mm. in the isolated tooth (M. 8591), while in the other (M. 8589), although the ramus prevents a measurement of the greatest height being obtained, that of the seventh plate is 63 mm. The most satisfactorily identified last molar of *E. melitensis* in the British Museum Collection for comparison with the above-noticed tooth from Crete, is a specimen situated in a right mandibular

* M. 8589, Phil. Trans. vol. 197 B (1904), p. 355, text-figs. 2 & 3; and M. 8591, *ibid.* p. 355, pl. 22. figs. 6, 6 *a*.

ramus (M. 44294), already described and figured by Dr. Leith Adams*. It is evident that in antero-posterior length it slightly exceeds the Cretan example and consists of several more plates, these being in much closer proximity owing to the narrowness of the cement-areas and the less massive enamel bands. Considering the size of the ramus this tooth must be much the higher of the two, while in breadth of crown the molar from Crete is superior.

The one other dental specimen obtained (M. 9379, Pl. XII. fig. 2) consists of only three unworn plates; the anterior surface of the foremost of these is strongly but simply grooved, its greatest width is 35 mm. and its height 50 mm.

The only bone procured from the deposit near Cape Maleka is the dorsal half of a vertebra embedded in the matrix attached to the mandibular ramus containing a last true molar (M. 9383).

From this brief account of the remains procured of *E. creticus*, it will be seen that this pigmy Elephant must have been of slightly larger proportions than *E. cypriotes* and approached in size more closely to *E. melitensis*; that is to say, it would have attained as a maximum a height of five feet†. All the molars obtained differ from those of the two last-named dwarf species in being much lower in the crown; this is perhaps the most noticeable feature of the series. At the same time the teeth are wide, the cement-areas broad, and the enamel simple, though at times broken up into a number of rings. So far as can be ascertained from the scanty amount of material the ridge-formula must have been low.

Except with regard to the immense difference in size the characteristics of the molars described above, more especially in the lowness of the crowns‡, appear to resemble more closely those of *E. meridionalis* than of any other of the larger Elephants of the Mediterranean Region.

II. ELEPHAS ANTIQUS Falconer.

As previously mentioned, remains of this Elephant§ had already been obtained from caves close to Retymno. The teeth and bones noted below, and believed to belong to this species, were all procured from a much damaged and fragmentary cave-deposit, one of several found close together in the cliffs bordering the south of Kharoumes Bay in the Eparkhia of Sitea||. Although evidently but a remnant of a formerly larger deposit, it was possible

* Trans. Zool. Soc. vol. ix. p. 30, pl. 6. figs. 1, 1 a.

† Leith Adams, Trans. Zool. Soc. vol. ix. pp. 108, 116.

‡ This characteristic of the molars of *E. meridionalis* was constantly noted by Falconer, see Pal. Mem. (London, 1868), vol. ii. pp. 128, 134, 138, &c.

§ Signor Simonelli does not give the author of his *E. prisus*, but it may be supposed that this name is employed for the thick-ridged variety of *E. antiquus* (Falconer's *E. prisus*, Cat. Foss. Mamm. Brit. Mus. part iv. p. 122), since the name *E. prisus* of Goldfuss appears to have been applied to molars almost indistinguishable from those of *E. africanus* (see Pomel, Bull. Soc. Géol. France, tome vii. 1878, p. 51).

|| Geol. Mag. n. s. dec. v. vol. ii. (1905), footnote 3, p. 199.

to trace the presence of Elephant bones for a depth of several feet. Some few remains of ruminants, similar to those found in other parts of the island, also occurred here, but were only observed close to the uppermost of the bones of the Proboscidian, which probably became extinct long before these smaller mammals.

It has already been mentioned elsewhere* that in another cave-deposit, on the same level—that is to say, not many feet above the sea, and only a few yards distant from the one under discussion,—were found a number of land-shells, *Helix pellita* Fér., a species seemingly not previously recorded in a fossil state†, these being preserved in the hard red breccia so common in cave-deposits. The presence of these shells points conclusively to the deposition of the mammalian remains under land-conditions, though it now appears just possible that these deposits were subsequently at all events partially submerged, which may help to account for their fragmentary condition. The occurrence of this movement is suggested by the discovery, in some sand adhering to a femur of *E. antiquus*, of a large number of foraminifera and other marine forms, an account and list of which have been published by the Rev. R. Ashington Bullen‡. Traces of a former submergence are more noticeable in the west of the island, especially at Sphinari and the Kutri and Haghios Basilis caves; it was also unexpected in the east, where the coastal movement is supposed to have been for long past in an opposite direction to that in the west §.

E. antiquus is represented by a number of limb-bones, including several perfectly preserved foot-bones, and a single right mandibular ramus (M. 9384) containing two somewhat damaged molars. Both from its size and from the fact of its having been found situated just above the limb-bones, it was at first sight thought that this last indicated the former occurrence in Crete of a small race of Elephant intermediate in size between the pigmy *E. creticus* and the very large species indicated by the remains noticed below. However, a further study of the material has caused the conclusion to be reached that it is a portion of the mandibular ramus of an immature specimen of *E. antiquus*, and that the teeth must be the penultimate and ultimate milk-molars, or perhaps the last of the milk and first of the permanent series. The general appearance and characters of these molars support this view of their identity, which is further strengthened by the fact of the large limb-bones occurring in the same deposit, and also that *E. antiquus* has already been recorded from another district of the island.

Lower Molars.—As already remarked, the two lower molars obtained, and believed to be those of *E. antiquus*, are situated in a portion of the right mandibular ramus shown in text-fig. 83 and Pl. XIII. fig. 3: neither of these teeth is quite complete.

* Geol. Mag. n. s. dec. v. vol. ii. 1905, footnote 2, p. 199; and Rev. R. Ashington Bullen, Proc. Malacol. Soc. vol. vi., Sept. 1905, p. 307.

† *Ibid.*

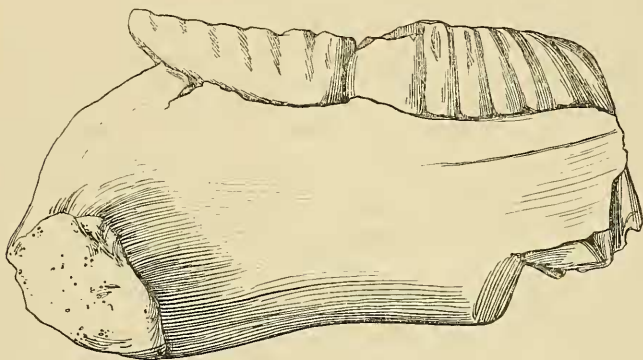
‡ Geol. Mag. n. s. dec. v. vol. iii. pp. 353-358, pls. 18 & 19.

§ For references to this, see Geol. Mag. n. s. dec. v. vol. ii. (1905), footnotes 2 & 3, p. 197.

The whole specimen is about 263 mm. (nearly $10\frac{1}{2}$ inches) in length; the ramus is robust, the greatest thickness in the portion preserved being 112 mm., and its depth, measured in front of the first molar, is about 126 mm. Its anterior border is very abrupt owing to the advanced state of wear and consequent forward position of the anterior of the two teeth.

Unfortunately neither of these molars retains its full complement of plates, which makes it impossible to determine with absolute certainty their exact position in the series, for, as may be seen by the specimens in the British Museum Collection, and has been pointed out by Dr. Leith Adams*, the milk-teeth of this species varied in size to a very great extent. However, it seems certain that the specimens in question represent either the two last milk-molars or the posterior of these and the first true molar.

Text-fig. 83.



Right mandibular ramus of *Elephas antiquus* (?) bearing two lower molars.
 $\frac{1}{3}$ nat. size:

The actual height of the foremost tooth (Pl. XIII. fig. 3 and text-fig. 83) is not shown, owing to the enveloping ramus; it consists of eight plates, but is extensively worn and projects considerably beyond the edge of the alveolus, so it is likely that there may have been one, perhaps two, additional plates originally. The present length of the crown, measuring along the median line of the plates, is 92 mm., and its greatest width, which occurs at the sixth of the plates present, is 47 mm., its height above the ramus at the same place is 30 mm. The cement-areas are not so wide as those of the following molar, but this is probably due to difference in wear; in neither is there any mesial expansion of the plates. The enamel bands are rather thin and "wavy" in outline, in both these respects differing from the specimens from Cape Maleka.

The second of the two teeth also shows eight plates, though it

* Mon. Brit. Fossil Elephants, Pal. Soc. London, 1877.

is evident that one or more may be wanting posteriorly. Only the anterior five are worn, and the enamel is seen to be less irregular than in the preceding molar, considerable digitation of the plates is observable, while the cement-areas are of considerable width. This molar is remarkable for its very great height, being 103 mm., while the greatest width of the crown at the second plate is only 43 mm. It will be remembered that this was given by Falconer* as one of the distinguishing characteristics of the molars of *E. antiquus*:—"Great height of the plates. The height is more than double the width of the crown." This is in striking contrast to the proportions of the teeth of *E. creticus*, in some examples of which the height of the crown is exceeded by its width. Particularly in the rather thin and very wavy outline of the enamel bands, these specimens from the Kharoumes deposit resemble a number of those of *E. mnaidriensis* figured by Dr. Leith Adams †, who also called attention to the resemblance between the molars of this Maltese species and those of *E. antiquus* ‡.

Limb-bones.—The specific or peculiar characters of the limb bones of *E. antiquus* do not appear to be well known, partly no doubt owing to the difficulty of distinguishing them in cases where the remains of more than one species of similar size occur in a single deposit, so that it is evidently chiefly by inference that the fragmentary collection of bones under discussion must be determined as those of this species. However, it will have to be acknowledged that this contention is a strong one when we consider the identity of the teeth found in the same deposit, and the discovery of the cave near Retymno from which were obtained similar, though more complete, remains. At least two individuals are represented amongst the limb-bones, which number about twenty and are almost all imperfect, with the exception of a few foot-bones; and in many cases the articular surfaces are damaged or missing, which makes it difficult to discern any features other than that of size. Nearly every specimen was covered with a thin red stalagmitic encrustation.

The only portion of the *spinal column* procured is a portion of the neural arch of a dorsal vertebra (M. 9388). The collection contains two *ulnae* (M. 9385), though only the proximal portion of each is preserved. One of these, which is unfortunately much crushed, is of the right side and apparently that of an adult. It seems to agree in size and general appearance with a corresponding bone of *E. antiquus* in the British Museum Collection (45203) §. A fragment of the *humerus* is still attached to the second specimen, which belongs to the left side and is that of a young individual, the line of junction between the shaft and the olecranon epiphysis being very apparent. On comparing it with the proximal portion of a left ulna in the Collection of the British Museum (45202) ||,

* Pal. Mem. vol. ii. p. 176.

† Trans. Zool. Soc. vol. ix.

‡ Mon. Brit. Fossil Elephants, Pal. Soc. 1877, pp. 25 & 50.

§ *Ibid.* p. 59, D. 12.

|| *Ibid.*